Organics on Mars: A Non-Biological Model

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McKay et al. (Science 273, 924) have discovered polycyclic aromatic hydrocarbons in martian meteorite ALH84001 and propose that they may be remnants of ancient life. While these authors have established that these organics are unlikely to be terrestrial contaminants, they do not address the plausible mechanisms by which non-biological PAHs could have been introduced into this meteorite on Mars. Non-biogenic PAHs have been found in a variety of meteoritic materials (Clemett et al., LPS XXIII, 233; Science 262, 721) which must be falling onto Mars. Indeed, the Viking GCMS experimenters expected to detect meteoritic organics preserved on Mars. No organics were in fact detected by Viking; this has been explained as the result of destruction of organics by solar-UV-driven chemical reactions in the martian soil (Chun et al. Nature 274, 875). However, this mechanism would not have been operating on the more clement Mars of 3.6By ago. PAHs falling onto Mars at this time would have been incorporated into the groundwater system which formed the carbonates in ALH84001 and moved down into the fractured bedrock which later became the meteorite. At this depth the UV-driven surface reactions would not occur, even if sufficient UV penetrated the thicker martian atmosphere of that time. An additional source of PAHs on the ancient Mars may have been the impact of the population of decaying satellites which has been postulated to explain the anomalously high abundance of visibly oblique impact craters on Mars (Schultz & Lutz-Garihan, Proc. LPSC 13th, A84). The resemblance reported by McKay et al. between the PAH mass spectrum in ALH84001 and that in CM2 chondrites suggests a similar history for organics in these meteorite classes. I suggest that the PAHs observed in ALH84001 are primordial solar nebula organics from asteroids, comets and former martian satellites which underwent alteration in a groundwater system on Mars similar to that which existed on the CM parent asteroid.

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